

Hydroxyl radical observations during the wintertime in Beijing and comparison with steady state model calculations.

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In Beijing poor urban air quality has a demonstrable effect on human health. During the wintertime, anthropogenic emissions from fossil fuel combustion can lead to high aerosol loadings and haze events. A high oxidation capacity on hazy days has previously been inferred from the significant contribution secondary organic aerosol (SOA) make to total PM_{2.5} (Huang et al., 2014). The hydroxyl radical (OH) mediates virtually all of the oxidative chemistry in the atmosphere, being responsible for the transformation of primary emissions into secondary pollutants such as NO₂, O₃ and SOA. Understanding the sources and sinks of OH in the atmosphere is essential in improving predictions of the lifetimes and chemical processing of pollutants and their transport within urban areas.

We will present OH and HO₂ measurements made in central Beijing during the recent 'An Integrated Study of AIR Pollution PROcesses in Beijing (AIRPRO)' project which took place in November and December 2016. OH measurements were made using the FAGE (Fluorescence Assay by Gas Expansion) technique, with the use of an inlet pre injector (IPI) which provides an alternative method to determine the background by injecting a scavenger (propane) to remove ambient OH. The OH measurements were made over a range of meteorological conditions including a number of haze days, with the average maximum OH concentration measured for the campaign being $\sim 2.5 \times 10^6 \text{ cm}^{-3}$ and for haze days the OH concentration reached levels of $\sim 3.5 \times 10^6 \text{ cm}^{-3}$ which is comparable to OH levels in non-haze days. We will compare the OH observations to steady state calculations constrained to the total OH reactivity and key OH precursors that were measured alongside OH. Through this comparison we will identify the major OH sources which sustain the wintertime oxidation capacity.

The current understanding is that gas-phase oxidation via the OH radical becomes less important in haze events due to lower light and ozone levels, making photochemistry less important (Wang et al., 2016). However, we will present evidence by comparing the dependence of the OH radical concentrations with PM_{2.5} levels that the OH concentration persists throughout haze events, and that there may be a missing source of HO_x under haze conditions. This finding implies an uncertainty in oxidation capacity during haze events.